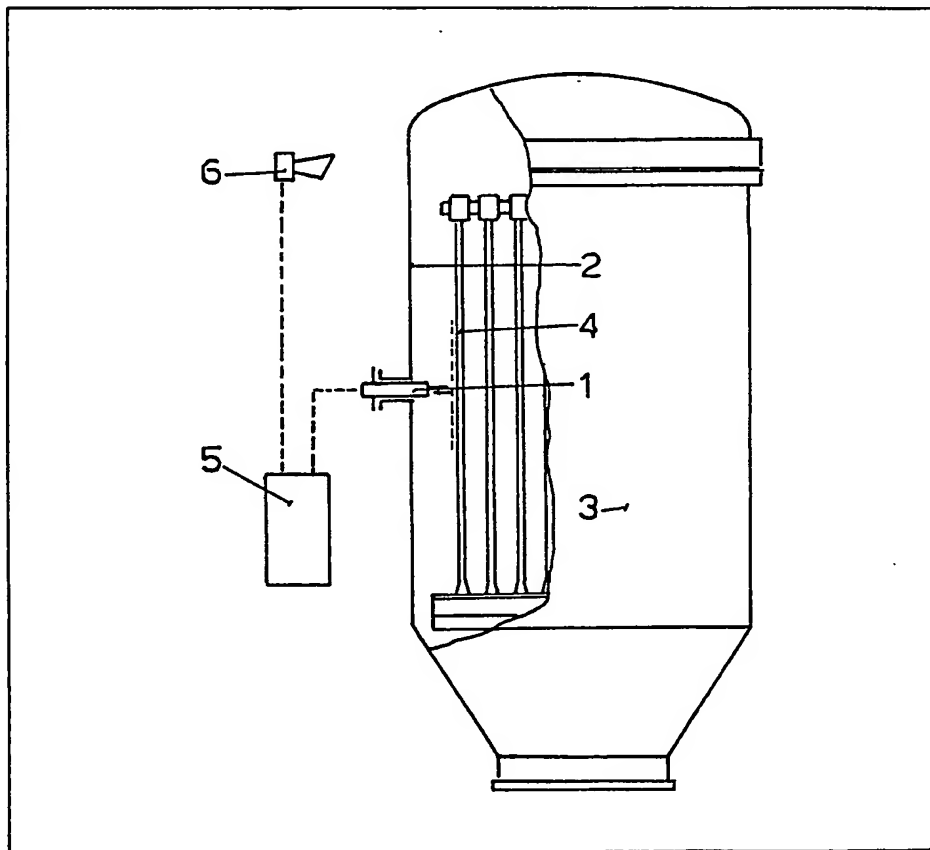


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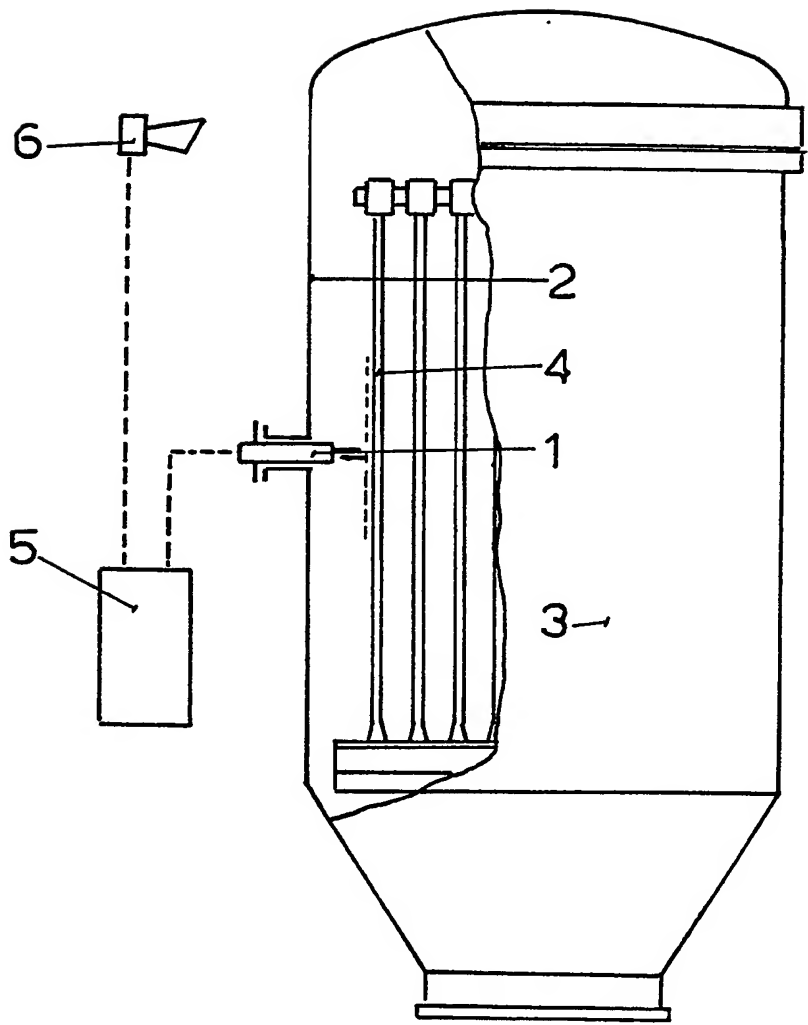
(54) A method and apparatus for determining the thickness of the filter-cake on a filterelement of a filter assembly.

(57) A method and an apparatus for determining the thickness of the filter cake on a filter element of a filter assembly by measuring the reflection time of an ultrasonic oscillation radiated towards the filter element 4 by a radiator 1 and its reflection received by a receiver 1, which may actuate a signal device 6 when the filter cake has attained a predetermined thickness.



The drawing originally filed was informal and the print here reproduced is taken from a later filed formal copy.

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SPECIFICATION

A method and an apparatus for determining the thickness of the filtercake on a filterelement of a filter assembly

The present invention relates to a method and an apparatus for determining the thickness of the filter cake on a filterelement of a filterassembly.

- 10 Such a method and apparatus are known, in which a sensing member, when meeting the filter cake which is build up during the filtration, is blocked up by the cake, after which a diaphragm is brought into movement by a differential pressure arising from the blocking up.

By means of this diaphragm-movement, a switching member may be actuated via a linkage for operating a signal device.

- This known apparatus is by its substantially 20 mechanical construction rather complicated and sensitive for failures. The present invention provides a completely new method and apparatus for determining the thickness of the filtercake, and is characterized, in that this takes place by measuring the reflection time of an ultrasonic oscillation radiated towards the filterelement.

- When applying the invented process, the ultrasonic oscillation may be radiated towards the filter element of which its cake thickness is to be determined, from a radiator mounted to a fixed base on or inside the filter wall and directed towards the filter element, and is the reflection of the oscillation received by a receiver also mounted to a fixed base on or inside the filter wall.

- 35 The reflection time of the oscillation is, in addition to the velocity of propagation of the oscillation in the medium to be filtered and present in the filter vessel, further dependent on the distance to be covered by the oscillation from the radiator to the reflecting surface and from this reflecting surface to the receiver. This distance, and with that, the reflection time, will decrease according as the filter cake thickness increases. During the forming and building up of the filter cake, the ultrasonic oscillation 45 radiated towards the filter element is reflected at first by the filter element itself and later on by the filter cake thereon.

- It certainly is not necessary that the reflecting surface should coincide with the outside of the cake, 50 but may very well be located more inside the cake, where the cake may have a bigger solidness or specific weight.

- Further the location of the reflecting surface with respect to the filter cake may be dependent of the composition and/or the material (crystalloid or non-crystalloid) of the cake.

- In a suitable embodiment of the invented method, the radiator and the receiver are arranged in a common housing and in the shape of a common 60 piezo-electric element. In this embodiment the ultrasonic oscillation is radiated towards the filter element in the shape of pulses and are the reflections processed between the pulses by the receiver.

- During the increase of the thickness of the filter 65 cake, the reflection time of the ultrasonic radiation

towards the filterelement decreases.

- In a very suitable embodiment of the method according to the invention, a switching device is actuated by means of the reflected signal when 70 attaining a predetermined minimum, to a predetermined limit of the cake thickness corresponding reflection time.

By means of this switching device a further device, such as a signal device, may be actuated.

- 75 When the reflected signal is visibly reproduced by a cathode ray oscilloscope, the reflection time may simply be reproduced on the time base of the oscilloscope as a distance, as is the case with the, corresponding to the cake thickness distance between the on or somewhat in the cake located reflection surface and the, originally this reflecting surface forming filterelement.

- The invention will be further illustrated by way of example with reference to the accompanying drawing, in which the single Figure is a schematic view of an apparatus in accordance with the invention.

- As illustrated a radiating-receiving element (1) for the ultrasonic oscillations has been mounted to the wall (2) of the filter vessel (3), and is directed towards 90 the filter element (4).

- The radiating-receiving element (1) which, preferably is a piezo-electric element, is connected to an electronic circuit (5), known by itself, and by means of which the reflection time may be measured and the signal device (6) may be energized when the reflection time attains a predetermined minimum value, corresponding to a predetermined cake thickness.

100 CLAIMS

1. A method for determining the thickness of the filter cake on a filter element in a filter assembly, characterized, in that this takes place by measuring 105 the reflection time of an ultrasonic oscillation radiated towards the filter element.

2. A method as claimed in claim 1, characterized, in that the ultrasonic oscillation is radiated towards the filter element in the shape of pulses.

- 110 3. A method as claimed in claim 1 or 2, characterized, in that on attaining a predetermined, to a predetermined limit of the cake thickness corresponding reflection time, a switching device is actuated by means of the reflected signal, to operate of 115 signal device, a pump or other device.

4. An apparatus for applying the method according to one of the preceding claims, formed by a filter assembly, characterized, in that same is provided with an ultrasonic radiator with cooperating receiver 120 and which are directed towards the filterelement.

5. An apparatus as claimed in claim 4, characterized, in that the radiator and the receiver are provided with a common piezo-electric element.

6. An apparatus as claimed in claim 4 or 5, 125 characterized, in that the receiver is connected to an electronic circuit by means of which a signal device, a pump or other device may be controlled.

7. A method for determining the thickness of the cake on a filter element in a filter assembly as herein 130 described with reference to the accompanying

drawing.

8. An apparatus for determining the thickness of the cake on a filter element in a filter assembly substantially as herein described with reference to

5 the accompanying drawing.

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